LHC-Beam Commissioning Working Group

Notes from the meeting held on
17 November 2009

Present: Carmen Alabau, Reyes Alemany, Ralph Assmann, Roger Bailey, Tobias Bär, Wolfgang Bartmann, Chiara Bracco, Oliver Brüning, Helmut Burkhardt, Andy Butterworth, Rama Calaga, Lene Drosdal, Massimiliano Ferro-Luzzi, Kajetan Fuchsberger, Rossano Giachino, Massimo Giovannozzi, Brennan Goddard, Per Hagen, Eugenia Hatziangeli, Barbara Holzer, Hitomi Ikeda, Lars Jensen, Verena Kain, Dobrin Kaltchev, Mike Lamont (chair), Yngve Levinsen, Alick Macpherson, Malika Meddahi, Gabriel Mueller, Giulia Papotti, Mario Pereira, Stefano Redaelli, Stefan Roesler, Adriana Rossi, Mariusz Sapinski, Frank Schmidt, Katarina Sigerud, Gennady Sivatskiy, Ralph Steinhagen, Ezio Todesco, Rogelio Tomas, Jan Uythoven, Glenn Vanbavinckhove, Simon White, Daniel Wollmann, Frank Zimmermann.

Excused: Bruno Puccio.

1. Follow-up from the last minutes

Follow-up: Systematic reversed polarity for all skew quadrupoles and sextupoles: sign convention reminded by Mike Lamont (slides).
Massimo Giovannozzi:

- The results can be understood taking into account the know rules for the machine. The key point is the clockwise rotation to transform a normal multipole into a skew. No inconsistencies were found within MAD-X and the correction affects only the polarity flag, which takes into account the machine conventions
- The polarity flag can be corrected in the database and hence in the MAD-X sequence. This is however, only a part of the problem, as the equivalent polarity flag in LSA will not follow.
- To be checked as well with skew elements next to focusing quadrupoles (all checks with beam were done with elements next to defocusing quadrupoles).

2. News from LMC – Mike Lamont (slides)

Summary notes from previous LMC meetings, written by Brennan Goddard or Frank Zimmermann, are available here.
What will be the LHC plans after the Christmas break? One option consists to start with a 3-4 week technical stop for QPS commissioning at 6 kA. Another option is still being discussed at the LMC. Final decision to be taken soon.
nQPS cables: have been selected according to specification on CERN store catalogue. Some of them have been damaged in the tunnel (see picture in Mike's presentation). An adapted mounting procedure is being put in place, which will allow the cables and connectors to withstand 1.9 kV.
Status of the powering:

- All Sectors in Phase II powering
- All Main circuits commissioned up to 2 kA.
- Main Bends in Sector 12: commissioned up to 4 kA with nQPS connected to interlock loop and to Quench Heaters.
- Tests status: 97% of all test steps done, 98% of the circuits ready for 1.2 TeV, 94% of the circuits ready for 3.5 TeV

- Sectors 12/23/56/78 given to operation (PGCs)

Splice mapping: preliminary results presented, looks good.
PGC status: very good progress.
Plans for this week: available at link under "Pre-beam planning and issues".

- Monday-Wednesday: Finish HWC, PGCs etc…
- Thursday-Friday: Global machine checkout
- Week end: beam ON.

Global machine check-out: Note that LHC access will most probably be required in the next days, so the programme will be updated accordingly.

Verena Kain: Experiments to give all beam permits as tomorrow onwards.

3. Dry Run news –Verena Kain

Consolidation performed for some systems. Not fully tested yet: Transverse damper, abort gap cleaning, feedbacks, alarms.
Reyes Alemany: Handshake tests with experiments went fine.

4. FiDel updates – Ezio Todesco (slides)

Decay of MQM and MQY with machine pre-cycle:
The decay measured in one MQY is smaller for the machine cycle (exponential decay of current vs linear ramp down) by about a factor two: it can be neglected in FiDeL as done up to now.
Dependence of the dipole decay on ramp rate:
Precycle only at 2 kA. The decay amplitude roughly linearly scales with flat-top energy. Measurements performed in this regime (but with 50 A/s ramp rate) show that the effect is about 5-6 times smaller than at 11.85 kA.
With a precycle at 10 A/s: Measurements of some Firm2 dipoles are giving a smaller effect of about a factor 2-2.5 w.r.t. 50 A/s**.** Could a 5 A/s ramp rate further reduce the decay?
Validation status: going on since few weeks: Cross-checking of Fidel implementation in LSA.

- Validation strategy - step 1:
  - Injection for TF done in 2008.
  - Injection and ramp to 1.2 TeV: successfully ended.
  - Decay and snapback correction of b3 in the dipoles for the 1.2 TeV run is in progress.

Comment: Snapback correction to be put in for the first ramp trial – ramp trial might already be done in a week time.

- Validation strategy -step2: Before January 2010:
  - Injection and ramp for all magnets to 3.5 TeV– static part only
  - Decay and snapback correction of b3 in the dipoles for the 3.5 TeV run -making use of the experience on the ramp at 1.1 TeV
  - Squeeze at 3.5 TeV - Critical part: hysteresis in LSA
- Solved issues
  - 'Very cold dipoles' - 10 units difference in dipoles tracked back to a wrong temperature (0 K!) setting for the MB, affecting the DCmag component – manually trimmed before the first 2009 injection test, solved a few days later
  - 'Wrong penetration' - Up to 30 units differences in MQM, MQY – due to a wrong implementation of the new penetration component – now corrected
  - Update: Minor errors corrected due to missing update (5 units in MQXB, 1.5 units in MQ, …)
- All the circuits have been successfully cross-tested.

- Field model issues : Compensators and spectrometers of IP2 and IP8: work in progress and results will be presented soon

Massimiliano Ferro-Luzzi: remember that ALICE solenoid is on purpose transversally displaced (generating about 16 μrad at 450 GeV). Cf Werner Herr, Chamonix 2006.

Mike Lamont: New ramp generated to 1.18 TeV – for a new clean situation.

5- LHC beam commissioning

Mike Lamont: The latest **LHC beam commissioning programme** is available at link under "3 week plan" and will be updated regularly by the LHC machine coordinator. Updated programme includes now MPS checks.
Over the weekend: inject, circulate and capture both beams working with one beam and then the other. Start with beam 1. If beam commissioning does start Friday evening, take both beams around overnight and give beam to RF during the day Saturday

Brennan Goddard: In the LHC beam commissioning programme, prioritisation of the stocking fillers is to be done.

Commissioning detectors with tests that require beam and interfere with beam operation (up to first collisions) – Massimiliano Ferro-Luzzi (slides)

List of tasks was shown together with how to possibly incorporate them into the LHC Beam Commissioning programme. See Massimiliano's presentation for full list and all detailed requirements.
Comments:

- Request for beam dump provoked by experiment protection system. Brennan Goddard: already done with LHCb, and ALICE. Massimiliano Ferro-Luzzi: will check again if they want to redo it;
- Experiments would like to have their solenoids on as soon as possible in the beam commissioning;
- New request: Commission ALICE and LHCb bump at 450 GeV, before the first 450 GeV collisions – as the first 3.5 TeV collisions will not be before next year.
- Request for short data taking periods with safe stable beam flag: Brennan Goddard: settings of the TCDQs and TCTs positions must have been commissioned. Mike Lamont: we must be sure that the beam is fully tuned, as specified;
- Parallel separation in as soon as possible: will be difficult to be done very early as tuning of the orbits will be needed;
- First collisions at 450 GeV/beam: start with 2x2 with about 5e10p/bunch. Better lose 20mn for switching on the experimental magnets after the ramp than risking damages at injection with experimental magnets on;
- Luminosity scans are done with stable beams.

6. A.O.B

8:30 meetings

- Chaired by HWC until Wednesday (if things go to plan)
- Thursday onwards: Chaired - joint HWC/LHC machine coordinators as required
- Continued involvement of HWC during initial phase considered vital

17:00 meetings will continue for discussion of more detailed operational issues.

9:00 meetings on Saturday & Sunday

Latest LHC beam commissioning news will be available at http://cern.ch/lhc-commissioning/news/LHC-latest-news.htm and will be updated by LHC machine coordinator.
Commissioning documentation is now available from the above site (see Documentation) and at G:\Departments\BE\Groups\OP\LHC\planning

Next meeting

Tuesday 24th November 2009, 15:30, 874-1-011. Agenda will be sent in due time.

Malika Meddahi.